Application of Discovery Learning Model Using Virtual Lab, Real Lab, and Computer Animations to Increase Student Learning Result Reviewed From The Ability of Critical Thinking Students

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Abstract - **This research was conducted with the aim to know: (1) discovery learning model interaction using Virtual Lab media, Real Lab, and Computer Animation to improve student learning outcomes reviewed from critical thinking ability of students; and (2) Correlation between students'critical thinking ability and learning outcomes. The result of the research is concluded: (1) there is interaction of the discovery learning model using the media to the students 'learning outcomes reviewed from thinking ability critical; and (2) There is correlation between thinking ability critical and student learning outcomes.**

Keywords— ability of critical thinking; computer animation; discovery learning model; learning outcomes; real lab; virtual lab

I. INTRODUCTION

Learning outcomes are changes in the behavior of learners in accordance with the abilities learned, and the ability to become self-directing and independent individuals [1]. These demands reqiurer quality learners, able to think critically, have high learning motivation and also able to solve problems in everyday life [3]. Critical thinking is the ability of students to think which is very important to be developed in schools. Teachers are expected to realize the learning that activates and develops critical thinking skills in students. Each student has a critical thinking potential, but the problem is how to develop that potential through the process of learning in the classroom. The students' critical thinking skills can be trained with learning that requires students to explore, inquire, discover and solve problems [5]. Discovery Learning is an inquiry based learning, constructivist and theory of how to learn. Learning models given to students have learning scenarios to solve real problems and encourage them to solve their own problems [7].

The using of discovery learning transfers the passive learning conditions become active and creative, teacher oriented to the student oriented learning, and change the expository mode students whom only receive information from the teacher to discovery mode students find their own information [6]. In addition to choosing the right learning model, to create an interesting learning for students, innovative learning media is needed and in accordance with the learning objectives, materials, students' circumstances and the tools available to create interesting learning [4]. Arsyad said that the use of media in teaching and learning process can

increase new interest, generate motivation and stimulation and bring psychological influence to students. A good learning process can be obtained by using interesting media, such as Real labs and Virtual labs [2].

II. METHOD

This research was conducted in December 2016 until April 2017, at Sultan Iskandar Muda High School, Jl. Tengku Amir Hamzah Pekan I, Medan Sunggal, Medan City. This research uses experimental method to test the interaction and correlation of the application of discovery learning model using virtual lab, real lab and computer animation to improve student learning outcomes in terms of students' critical thinking ability. The study involved three independent variables (discovery learning using virtual lab, real lab and computer animation), two moderator variables (high and low ciritical thinking skills) and one dependent variable (students' chemistry learning outcomes). The instrument used is the test of learning result on the subject of acid base titration and the students' critical thinking ability test. Data analysis techniques use two-way ANAVA and correlation coefficient.

III. RESULT AND DISCUSSION

1. Data Description

Data of students 'chemistry learning result, grouped based on interaction between class (model and media) with students' critical thinking ability.

Table 1. Comparison of Student Chemical Learning Results by Class and The Ability of Critical Thinking Students

The Ability of Critical Thinking	Class			Total
	Discovery with Real Media Lab (A1)	Discovery with Computer Animation Media (A2)	Discovery with Virtual Media Lab (A3)	
High (B1)	$94,29 \pm 6,517$ (n = 14)	$90,0 \pm 5,976$ (n = 8)	$92,31 \pm 6,330$ (n = 13)	$92,57 \pm 6,227$ (n = 35)
Low (B2)	$82,31 \pm 6,038$ (n = 26)	$75,0 \pm 6,297$ (n = 30)	$86,09 \pm 7,681$ (n = 23)	$80,63 \pm 8,061$ (n = 79)
Total	$86,50 \pm 8,336$ (n = 40)	$78,16 \pm 8,732$ (n = 38)	$88,33 \pm 7,746$ (n = 36)	

Based on Table 1 above, it can be explained that the average learning outcomes of students who are taught discovery learning model using virtual lab media (88.33 ± 7,746) higher than students who learn discovery learning model with real lab media (86,50 ± 8,336) or students who are learning discovery learning model using computer animation media (78,16 ± 8,732). Furthermore, it can be explained that groups of students who have high critical thinking ability (92,57 ± 6,227) get higher learning outcomes than students who have low critical thinking ability (80,63 ± 8,061).

2. Hypothesis Testing

Hypothesis testing was analyzed using two way analysis technique (two way anova) with the help of SPSS 20.0 program.

Table 2. Results of Two-Path Variance Analysis

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5260.869^a	5	1052.174	24.795	.000
Intercept	695754.854	1	695754.854	16395.739	.000
CLASS	732.741	2	366.370	8.634	.000
KBK	2836.045	1	2836.045	66.833	.000
CLASS * KBK	298.177	2	149.089	3.513	.033
Error	4582.991	108	42.435		
Total	819950.000	114			
Corrected Total	9843.860	113			

a. R Squared = .534 (Adjusted R Squared = .513)

Based on the results of hypothesis analysis and testing in Table 2 above, obtained some conclusions as follows:

a. In the CLASS field obtained F value of 8.634 and the value of sig. 0,000. Because the sig value. 0.000 <0,05, therefor it can be concluded that there is difference of result of study of chemistry between student which taught with learning model of dicsovery using virtual lab media compared to result of learning of student which taughtwith dicscovery model using real media lab and computer animation media.

b. In looking at the KBK column (critical thinking ability) obtained the value of F of 66.833 and the value of sig. 0,000. Because the sig value. 0.000 <0,05 it is concluded that there is difference of result of study of chemistry between group of student having high critical thinking ability with group of student having low the ability of critical thinking.

c. In the interaction CLASS * KBK obtained F value of 3.513 and the value of sig. 0.033. Because the sig value. 0,033> 0,05 hence can be concluded that there is influence of interaction between applying of discovery learning model using virtual lab media, real lab and computer animation media to student's chemical learning result from student's critical thinking ability.

3. Correlation Testing

Correlation test is intended to know the correlation between students 'critical thinking ability with students' chemistry learning result. Correlation test was analyzed with the help of SPSS 20 program.

Table 3. Results of Correlation Testing

Class	Correlation	N	Pearson Correlation	Sig. (2-tailed)
Real Lab	X_1Y_1	40	0.488	0.001

Computer Animation	X_2Y_2	38	0.644	0.000
Virtual Lab	X_3Y_3	38	0.444	0.007

Based on the results of analysis and correlation test in Table 3 above, obtained some conclusions as follows:

a. There is a correlation between the ability to think critically with the learning outcomes of students that learned by model discovery using real lab media with the value of pearson correlation (rx_1y_1) of 0.488 and the value of sig. of 0.001.

b. There is a correlation between the ability to think critically with student learning outcomes that learned bymodel discovery learning using computer animation media with the value of pearson correlation (rx_2y_2) of 0.644 and the value of sig. of 0,000.

c. There is a correlation between the ability to think critically with the learning outcomes of students that learned by model discovery using virtual lab media with value pearson correlation (rx_3y_3) of 0.444 and the value of sig. of 0.007.

IV. CONCLUSION

1. There are differences in the results of chemistry learning between students who were taught by learning model dicscovery using virtual lab, real lab or computer animation media (F = 8,634 and sig = 0,000). Student learning outcomes of learning model discovery with virtual lab media (88,33) higher than student learning result with media real lab (86,0) and with computer animation media (78,16).

2. There are differences in the learning outcomes between students who have high critical thinking skills as well as those with low critical thinking skills (F = 66.833 and sig = 0,000). A group of students with high critical thinking ability (92,57 ± 6,227) obtained higher learning outcomes than students with low critical thinking ability (80.63 ± 8,061).

3. There is interaction effect between discovery learning model using virtual lab, real lab and computer animation media and students' critical thinking ability to student's chemistry learning result (F = 3,513 and sig value = 0,033).

4. There is a correlation between the ability to think critically with the students' chemistry learning outcomes, which are taught by discovery learning model using real lab media (rx_1y_1 = 0,488 and sig = 0.001), virtual lab media (rx_2y_2 = 0,644 and sig. = 0,000), by using computer animation media (rx_3y_3 = 0,444 and sig. = 0,007).

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